REMARKS

Reconsideration of the Examiner's objections to the claims is respectfully requested having regard to the foregoing amendments and the following submissions.

Claim objections based on 35 USC § 112:

The wording problem identified by the Examiner has been rectified by the amendment of Claim 1 to substitute for "reflected from both projectors" the revised wording - - from both projectors that is reflected from the object - - , which revised wording applies also to the claims dependent therefrom. The detected light is now specified to be that reflected from the object as a consequence of its illumination by the projectors.

Claim objections based on 35 USC § 102:

It is respectfully submitted that Claim 1 as amended is not anticipated by the cited Jurca US Patent No. 5,933,240. The following distinctions apply:

a) Jurca discloses a method and apparatus for determining the distance between a base and a specular surface by means of radiation reflected at the surface. A specular surface is one having a very high degree of reflectivity, an everyday mirror being a common example. The techniques for measurement of specular surfaces (namely, measurement of their distances from some reference base) are different from those for measuring diffuse non-specular surfaces, such as the peripheral surfaces of logs. The apparatus of the present invention was devised for use in the scanning of the non-specular surfaces of objects. In amended Claim 1, the scan head is defined as being for use in a scanner for measurement of non-specular surfaces.

b) Jurca uses time-division multiplexing to prevent individual measurements from influencing each other by any stray light of the other measurement. This enables the two measurements to be separated more completely and to enable compensation for measurement imbalances. In contrast, the apparatus of the present invention, as specified in amended Claim 1, uses time-division multiplexing to provide redundancy

in the detector outputs for facilitating discrimination and identification of the image from the image data provided by the detectors. Jurca does not disclose this functionality of time-division multiplexing.

c) Further, the apparatus defined by Claim 1 is suitable for use with coded light, whereas Jurca's apparatus is not. Jurca measures single direct reflection using divergently radiating light. Jurca could not function effectively using projected bar patterns; these would cause voids and ambiguities in the reflection data. By contrast, the apparatus of the present invention is adapted to permit projection and detection of discrete symbols formed in alternating light and dark patterns. Using the inventive apparatus, a projected symbol that is not found in the received image signal need not cause a complete mismatch of the image data, whereas Jurca is susceptible to this potential defect.

Claim objections based on 35 USC § 103:

The Examiner has conceded that Jurca does not disclose the use of coded light. Indeed, the Jurca technique is useful only for the measurement of specular surfaces, for which a coded-light technique is completely unsuitable. The Examiner has then suggested that the cited Kuchel US Patent No. 5,135,309 could be combined with Jurca to deliver the subject-matter of the present invention to the reader of both cited references, contending that "it would have been obvious to one of ordinary skill in the art... to utilize the bar pattern projectors of Kuchel as the projectors in the device of Jurca in order to detect ambiguities on the surface of an object to be measured".

Applicants respectfully traverse. Since Jurca discloses apparatus suitable only for measurement of specular surfaces, and Kuchel discloses apparatus suitable only for measurement of non-specular surfaces, no one skilled in the art would look to Jurca in the first place to learn anything about measurement of non-specular surfaces.

If two items of prior art can constructively combined, a person skilled in the art must be presumed to have started with one of the two that leaves a gap in the information that such hypothetical person is seeking. If the person skilled in the art is involved with the design of scanners of specular surfaces, such notional person will not expect information about scanners of non-specular surfaces to be of any value whatsoever in relation to the characteristics of projected light nor the characteristics of the detector(s) of

such light. Equally, if such notional person is involved with the design of scanners of non-specular surfaces, such notional person will not expect information about scanners of specular surfaces to be of any value whatsoever in relation to such system parameters.

The present invention is directed to scanners of non-specular surfaces. It is therefore appropriate to consider the notional designer of such scanners who is seeking published prior-art guidance as to the problems that such designer seeks to solve. That notional designer would be expected to refer to literature relating to non-specular surface scanners.

Accordingly, we might hypothesize that the notional designer learns of the Kuchel patent. But that notional designer is likely to reject Kuchel immediately as a source of useful information, as Kuchel's disclosed apparatus includes only a single camera. Therefore, the designer would not be possible to begin with Kuchel as a useful starting point, since it would not be possible to utilize time-division multiplexing in the same manner as that defined in Claim 1, which posits apparatus having both two projectors and two detectors (cameras). So Kuchel would probably be discarded immediately as a potential source of useful information.

If the hypothetical designer of scanners of non-specular surfaces somehow overcame the foregoing non-start and found Kuchel to be somewhat informative about projection of bar patterns, such person would not be expected then to look to Jurca to expand the Kuchel disclosure, since Jurca's limitation to specular surface measurement would be expected to render Jurca's teaching completely irrelevant to any expanded functionality of Kuchel.

Further still, there is nothing in Kuchel suggesting that one should look elsewhere to learn about time-division multiplexing. Equally, there is nothing in Jurca suggesting that one should look elsewhere to learn something useful about projecting coded light. And if one attempted to combine Jurca and Kuchel, one would end up with a hybrid apparatus "neither fish nor fowl", an awkward and unsuccessful juxtaposition of a specular-surface measuring device with a non-specular-surface measuring device, having no practical utility beyond the bare teachings of Jurca and Kuchel taken independently.

Reverting to the Examiner's suggestion that "it would have been obvious to one of ordinary skill in the art ... to utilize the bar pattern projectors of Kuchel as the projectors in the device of Jurca in order to detect ambiguities on the surface of an object to be measured", the Examiner's premise is, with respect, unfounded. It is unfounded not only for the reasons given above, but also for the important reason that Jurca's specular-surface scanner could not function effectively using projected bar patterns, as these would cause voids and ambiguities in the reflection data, rendering the data unreliable and, in many cases, completely useless.

It is therefore clear that no person skilled in the art would have combined the Jurca and Kuchel teachings as suggested by the Examiner or at all.

Added claims:

New Claims 29-31 further characterize the coded light of Claim 2. The light is coded for a de Bruijn pattern comprising a sequence of discernible pattern elements, the sequence being selected so that any sub-sequence thereof of a predetermined length is unique within the sequence.

This preferred pattern defined in new Claims 29-31 has its origins in the Applicants' prior U.S. Patents Nos. 5,615,003 issued 25 March 1997 and 5,986,745 issued 16 November 1999, both of which have been incorporated herein by reference. A discussion of the prior Hermary apparatus begins at ¶0019 of the present specification. ¶0021 briefly summarizes the preferred coding. An exemplary such coding is set forth in ¶0025, with reference to the introduction thereto in ¶0024. ¶0023 reads as follows:

> **[0023]** In a preferred embodiment of the previous Hermary technology, the coding of the projected pattern of light or other suitable radiation is selected to conform to a sequence of boolean values chosen so that any sub-sequence of length N bits is unique within the complete sequence. (N is a parameter suitably chosen by the designer and may desirably be empirically selected to achieve an acceptably low proportion of rejected or unreliable image reflection data.) Such coding conforms to de Bruijn cycles or patterns, acknowledging the work of N. G. de Bruijn who analyzed such coded patterns in 1946. Such patterns are conveniently described in "The Art of Computer Programming" (D. E. Knuth, v1, 2nd edition, Addison-Wesley, 1973). With

this coding, it is possible to analyze the received light and locate the position of a received pattern of N bits uniquely within the original projected beam.

Some preferred options as to the de Bruijn coding are set forth in ¶0062. Further details as to the preferred pattern/coding may be obtained from the Applicants' prior patents mentioned.

The foregoing coding is preferred, and serves to delimit the present invention further relative to the prior art. Specifically, relative to Kuchel, the non-repeating sequential duty cycle code embedded into light projection according to the preferred embodiment of the present invention may be contrasted with the regular grating shaped pattern that Kuchel specifies.

Concluding submission:

Applicants submit that the claims as amended completely avoid the prior art cited, taken individually or awkwardly in an unsuitable combination unimaginable to a person skilled in the art at the relevant date. The wording of the claims is now in good order. Allowance of the application is respectfully requested.

Respectfully submitted,

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